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Variations in Mortality From Coronary Disease*

THE recorded mortality from arteriosclerotic heart disease, including coronary disease, in the United States varies not only with age but also with regard to sex, race, marital status, geographic region, and other factors. As the table on page 2 shows, the death rate from this cause at ages 35-44 is 6.6 times as high among white males as among white females. At ages 45-54, the ratio is still as high as 5.3 to 1, but then decreases progressively with advance in age, until at ages 85 and over the death rates for the two sexes are not very different. Among nonwhite persons, however, the sex differences in the death rate from arteriosclerotic heart disease are much smaller than those among white persons and vary comparatively little with age.

In England, Canada, and Australia, the sex differences in the mortality from arteriosclerotic heart disease are similar to those for white persons in the United States. On the other hand, in Italy and Portugal the sex ratio is approximately the same as for nonwhites in our country, that is, the rate among males is about 1½ times that among females. Any theory as to the etiology of the disease should account for the sex differences between countries as well as for the disparity between the color groups in the United States.

It is apparent from the table that the death rate from arteriosclerotic heart disease for nonwhite males is not markedly different from that among white males at the ages under 45. But beyond this point the recorded mortality rates for nonwhite men fall increasingly below those for white males. Part of this difference undoubtedly reflects faulty certification of deaths from this cause among older nonwhite males.

In sharp contrast to the situation among males, the mortality rates

*This is the second of two articles based upon a paper, "Some Implications of Mortality Statistics Relating to Coronary Artery Disease," presented by Edward A. Lew, Actuary and Statistician of the Metropolitan Life Insurance Company, at the Conference on Atherosclerosis and Coronary Heart Disease sponsored by the New York Heart Association, January 15, 1957. The first article, "Trend of Mortality From Coronary Artery Disease," appeared in the February 1957 issue of the STATISTICAL BULLETIN.

MORTALITY FROM ARTERIOSCLEROTIC HEART DISEASE, INCLUDING CORONARY DISEASE
By Color, Sex, and Age. United States, 1954

Age Period (Years)	Death Rates per 100,000				Percentage			
	White		Nonwhite		Male of Female Rate		White of Nonwhite Rate	
	Males	Females	Males	Females	White	Nonwhite	Males	Females
All Ages*	275.2	127.0	186.3	122.8	217	152	148	103
0–24	0.5	0.3	1.0	1.0	167	100	50	30
25–34	10.3	2.1	14.9	9.8	490	152	69	21
35–44	81.0	12.2	80.5	50.4	664	160	101	24
45–54	331.0	62.7	270.4	168.0	528	161	122	37
55–64	839.0	262.2	634.0	386.4	320	164	132	68
65–74	1,728.6	878.3	1,146.1	784.2	197	146	151	112
75–84	3,285.9	2,330.8	1,644.4	1,181.1	141	139	200	197
85 and over	5,456.3	4,886.6	1,980.0	1,648.7	112	120	276	296

*Death rates adjusted for age on basis of age distribution of total United States population (except Armed Forces overseas), April 1, 1940.

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from arteriosclerotic heart disease for nonwhite females are four times those for white females at ages 35-44, and more than 2½ times at ages 45-54. Even at ages 55-64, nonwhite females are subject to a death rate 1½ times that for white females.

Arteriosclerotic heart disease mortality is significantly higher for the widowed, the single, and the divorced than for the married. It would appear, therefore, that factors associated with marital status —selectivity of marriage and the more favorable environment of the married—have a definite influence on the level of mortality from the disease.

Considerable variation is observed in the arteriosclerotic heart disease mortality from one area of the country to another. The age-adjusted death rates in 1950 were highest in the Middle Atlantic and New England regions, where the rates were 273 and 250 per 100,000, respectively, and were lowest in the East South Central region (160 per 100,000). In general, the highly urbanized areas had the highest death rates from the disease, while predominantly agricultural areas recorded low rates. The differences in mortality between regions are probably due in part to differences in the terminology used in certifying causes of death and in part to real geographic variations in the incidence of the disease.

An insight into the relation between arteriosclerotic heart disease death rates and socioeconomic status can be obtained from the

mortality experience among Ordinary and Industrial policyholders of the Metropolitan Life Insurance Company. Industrial policyholders represent for the most part urban wage-earners in the lower income brackets, while the Ordinary policyholders are drawn mainly from the urban middle and well-to-do classes of the population engaged in nonhazardous occupations. The death rates from arteriosclerotic heart disease among white men in the two classes show an inverse relationship between mortality and socioeconomic status at ages under 65—that is, the Industrial policyholders experience distinctly higher death rates from the disease than Ordinary policyholders. These findings are contrary to what might have been expected, inasmuch as the higher socioeconomic groups generally can obtain better diagnoses, are subject to greater social and occupational stresses, and have richer diets.

A number of studies show that people who are overweight experience a markedly higher total mortality than persons of about average weight, and that this excess mortality is due primarily to cardiovascular disease. A recent study by the Metropolitan Life Insurance Company disclosed that insured lives who not only were moderately overweight but who also had a slight or moderate elevation in blood pressure experienced very high mortality from heart disease, with arteriosclerotic heart disease responsible for most of the excess.

There are statistical findings which strongly suggest that hereditary factors have a considerable influence on the level of mortality from heart disease. A recent intercompany investigation of insured lives showed that persons who on their application for Life insurance had reported two or more cases of cardiovascular-renal disease under age 60 in their families were themselves subject to death rates from cardiovascular disease which were from 1¾ to 2½ times those prevailing among standard risks.

In view of the many factors which affect the death rate from arteriosclerotic heart disease, it is important to guard against the tendency to oversimplify and overgeneralize in accounting for the variations in the incidence of the disease. A hypothesis of multiple causation appears to be most consistent with the known facts.

Family Disruption by Death

THERE now are nearly 39,000,000 married couples in the United States. Together with their children under 18 years of age, these family groups include almost 130,000,000 persons—about three fourths of our total population. Wide interest, therefore, attaches to the chances that a family will be disrupted by the death of one of its

CHANCES OF DEATH IN TYPICAL FAMILIES

Chances That Husband Will Die Within Specified Number of Years and Corresponding Chances of at Least One Death Among Members of a Family. White Population, United States, 1954

Age of Members in Typical Families					Chances per 1,000 of Dying Within											
Husband	Wife	Children			5 Years			10 Years			15 Years			20 Years		
		First	Second	Third	Husband	Others	Total	Husband	Others	Total	Husband	Others	Total	Husband	Others	Total
20	19	1	—	—	9	8	17	17	14	30	26	21	46	38	33	70
25	23	3	1	—	8	11	19	17	20	36	30	32	61	50	52	99
30	28	6	3	1	9	14	23	22	28	49	42	48	88	76	78	149
35	32	9	6	4	13	13	26	33	31	63	68	59	122	120	97	205
37	34	11	8	4	15	15	30	41	36	75	82	67	144	142	109	235
39	36	13	10	6	19	17	35	50	42	90	99	77	169	168	123	271
41	38	14	10	6	23	19	41	61	47	105	118	86	194	199	136	307
43	40	15	11	7	29	21	49	74	53	123	140	97	223	233	152	349
45	41	16	12	8	35	23	58	89	57	142	166	103	252	272	162	390

Note: Mortality based on United States life tables for 1954.

members within specified periods of time. The accompanying table shows these chances for several typical white families of varying composition; figures are also given for the husband alone and for the other family members as a group.

Although the chances of an early death in young families are not great, they are by no means negligible. For example, where the husband is 20 years of age, the wife 19, and the child an infant, the chances are 17 per 1,000 that one or more members will die within five years. Naturally, the probability of death is greater for larger families and also where the parents are older. Thus, the chances of at least one death within five years in a family which consists of five members are 26 per 1,000 if the father is 35 years of age, and increase to 58 per 1,000 if he is 45.

In families where the father is relatively young, the chances are that he will not be the first member of the family to die. On the other hand, in well-established families it is likely that the husband will predecease any other member of the family. For example, the chances of death within 10 years are greater for a husband aged 35 or older than for the remainder of his family—which consists of his wife and three children, according to the illustration in the table. Where the father has passed his 40th birthday, he is likely to be the first to die even within a one-year period.

Family life in our country has benefited greatly from the long-term decline in mortality. Nevertheless, even now a very considerable number of homes are disrupted each year by the premature death of the family head or his spouse. In 1955, about 82,000 American husbands and wives died before reaching their 45th birthday. In most of these families the surviving members were confronted with a variety of new problems, particularly where the death involved the father of young children.

Although family building usually starts at a relatively early age in our country, the chances are appreciable that the family head will fail to survive until his youngest child has become self-supporting. Thus, for a husband aged 25, the chances are 50 in 1,000 that he will die within 20 years. Moreover, with advance in age these chances rise rapidly; they are 120 in 1,000 if he is 35 years old, and 272 in 1,000 if he is 45.

To provide for contingencies such as the premature death of the breadwinner or expenses incidental to the death of other members of the family, Americans include in their budget an allowance for savings and Life insurance. Inasmuch as the family is the basic unit in our society, a number of Life insurance companies now cover in a single policy the entire family, including children yet to be born.

Accidents Among the Aged

CONSIDERABLE progress has been made in the United States during the past two decades in reducing the mortality from accidents among persons at ages 65 and over. In the past six years alone the decrease has amounted to 15 percent, the death rate dropping from 210 per 100,000 in 1950 to about 180 in 1956. Nevertheless, accidents in our country still take more than 25,000 lives a year at ages 65 and over, a higher toll than from any other cause except the cardiovascular diseases and cancer.

As older people advance in age, the accident death rate among them rises sharply. Among white men in 1953-54, the mortality increased from 141.7 per 100,000 at ages 65-74 to 730.7 at ages 85 and over. Much more rapid was the corresponding rise among white women—from 72.1 to 903.0 per 100,000. As a result of this difference in the two age curves, the sex-ratio of the mortality changes with advance in age. Whereas at ages 65-74 the accident death rate among men was twice that for women, at ages 85 and over women had the higher rate by an appreciable margin.

Table 1 shows the relative frequency of fatal accidents among older people by place of occurrence. Two main facts emerge from these data: transport and home accidents together account for about two thirds of all the deaths from accidents at almost every age group in each sex; secondly, accidents in and about the home account for an increasing proportion

TABLE 1—PERCENT DISTRIBUTION OF DEATHS FROM ACCIDENTS BY PLACE OF ACCIDENT
White Persons, by Sex, Ages 65 and Over. United States, 1953-54

Place of Accident	White Males			White Females		
	Ages 65-74	Ages 75-84	Ages 85 and over	Ages 65-74	Ages 75-84	Ages 85 and over
All Places	100	100	100	100	100	100
Transport	42	29	12	30	10	3
Nontransport	58	71	88	70	90	97
Home	23	36	51	44	57	63
Resident institutions	4	9	12	7	11	12
Street and highway	4	4	3	2	2	1
Farm	5	3	1	*	*	*
Public buildings	3	2	1	2	1	1
Industrial places and premises	2	1	*	*	*	*
Other specified places	6	3	2	2	1	1
Unspecified	11	13	18	13	18	19

*Less than 0.5.

Source of basic data: Reports of National Office of Vital Statistics.

TABLE 2—DEATH RATES FROM ACCIDENTS BY TYPE
White Persons, by Sex, Ages 65 and Over. United States, 1953-54

Type of Accident	Average Annual Death Rate Per 100,000			Percent Distribution		
	Ages 65-74	Ages 75-84	Ages 85 and over	Ages 65-74	Ages 75-84	Ages 85 and over
	White Males					
Accidents—Total	141.7	303.4	730.7	100	100	100
Falls	43.7	151.7	545.2	31	50	75
Motor vehicle—total	54.2	82.2	76.1	38	27	10
Collision with pedestrian	24.6	46.4	47.9	17	15	7
Burns and conflagrations	9.4	22.0	40.0	7	7	5
Fire and explosion	8.3	19.2	33.3	6	6	5
Drowning (excluding water transportation)	4.6	5.1	5.5	3	2	1
Machinery	3.8	3.1	1.3	3	1	*
Railway	3.4	4.6	6.7	2	2	1
Absorption of poisonous gas	2.7	4.1	3.9	2	1	1
Firearm	1.9	2.0	1.5	1	1	*
Poisoning by solids and liquids	1.2	1.1	2.2	1	*	*
Inhalation and ingestion of food or other objects	1.0	2.1	5.3	1	1	1
All other	15.8	25.4	43.0	11	8	6
	White Females					
Accidents—Total	72.1	275.0	903.0	100	100	100
Falls	36.5	213.0	802.6	51	77	89
Motor vehicle—total	21.1	26.4	24.7	29	10	3
Collision with pedestrian	7.1	12.3	10.2	10	4	1
Burns and conflagrations	5.8	15.2	22.7	8	6	3
Fire and explosion	5.2	13.1	18.6	7	5	2
Drowning (excluding water transportation)	.6	.9	.8	1	*	*
Machinery	.1	.1	.1	*	*	*
Railway	.6	1.1	.5	1	*	*
Absorption of poisonous gas	1.1	2.1	2.7	1	1	*
Firearm	.1	.1	0	*	*	*
Poisoning by solids and liquids	.6	.4	.5	1	*	*
Inhalation and ingestion of food or other objects	.4	.9	2.2	1	*	*
All other	5.2	14.8	46.2	7	6	5

*Less than 0.5.
Source of basic data: Reports of National Office of Vital Statistics.

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of the total accident mortality with advance in age, complementing the experience for transport accidents. Thus, among white males in 1953-54, the proportion of home to all fatal accidents increased from nearly one fourth at ages 65-74 to one half at ages 85 and over; among white females, the corresponding increase was from somewhat over two fifths to nearly two thirds.

An appreciable number of accidental deaths among older people

occur in resident institutions, such as homes for the aged, nursing homes, and hospitals. About one tenth of all the fatal injuries at ages 75-84 were sustained in such institutions; at ages 85 and over, the proportion was one eighth. These relatively high proportions reflect the very considerable number of aged in resident institutions as well as their proneness to accidental injury. The fatal accidents which occur among the aged on farms, in public buildings, and in industrial places are largely concentrated among men.

Table 2 shows the relative frequency of fatal accidents by type. Falls comprise a large and increasing proportion of the total accident mortality during later life. Among white males falls were nearly one third of all accidental deaths at ages 65-74, one half of the total at ages 75-84, and three fourths at ages 85 and over. The proportions are even larger for white females, ranging from one half at ages 65-74 to nine tenths at the oldest ages.

Motor vehicle accidents rank second as a cause of fatal injury among older people as a group; in fact, among men at ages 65-74 such accidents outrank every other type, including falls. In this age group, motor vehicle accidents accounted for nearly two fifths of the total accident mortality among men and for somewhat over a fourth among women. Pedestrians constituted a majority of the traffic fatalities among men at ages 65 and over; among women the proportion was almost as large.

Fires and burns by other means rank third as a cause of accidental death at the older ages among both men and women. Most of these victims are trapped in burning buildings; a large number are unable to escape because of the infirmities of old age. Other causes of fatal injury which takes an appreciable toll of life among elders, particularly men, include drowning, machinery accidents, railway accidents, and the absorption of poisonous gas.

Cirrhosis of the Liver: A Leading Cause of Death

CIRRHOSIS of the liver has long been a fairly common chronic disease of adult life and, with the marked reduction in mortality from the infectious diseases, has emerged as one of the 10 leading causes of death in the United States. In fact, at ages 45-64, the only diseases which outrank cirrhosis of the liver as causes of death are heart disease, cancer, and cerebral hemorrhage. In 1956 the disease accounted for a total of about 18,000 deaths in our country; about two thirds of them were among males. Nationwide morbidity data for the disease are lacking, but a recent study in New York

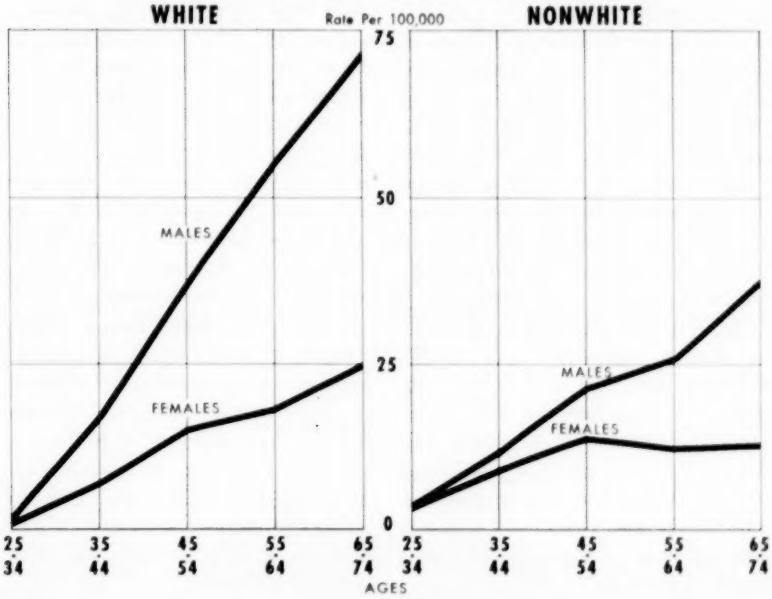
City showed that it accounted for nearly 2½ percent of all cases of hospitalized chronic disease.*

The mortality from cirrhosis of the liver is largely concentrated in middle and later life. As may be seen in the accompanying chart, the death rate from the disease among the Industrial policyholders of the Metropolitan Life Insurance Company increases progressively with age in each color-sex group except colored females, among whom the rate levels off beyond midlife. Even among white persons and nonwhite males, the death rates do not rise much beyond age 75, judging from data available for the general population of the United States.

Actually, the increase in the mortality from cirrhosis of the liver with advance in age is considerably less rapid than for most other chronic diseases. For example, in this insurance experience for 1951-55 the death rate from the disease among white persons was about four times as high at ages 65-74 as at ages 35-44; for heart disease the corresponding increase was about 18 times for white

*Fraenkel, M., and Erhardt, C. L., *Morbidity in the Municipal Hospitals of the City of New York*, Russell Sage Foundation, New York, 1955.

AVERAGE ANNUAL DEATH RATES PER 100,000 FROM CIRRHOSIS OF THE LIVER
By Color and Sex, Ages 25-74 Years
Industrial Policyholders, Metropolitan Life Insurance Company, 1951-55



males and 30 times for females.

Males record a higher death rate from cirrhosis than females. Within the age range 35-74 years, the mortality among white males varied from 2⅓ to 3 times that among white females; for colored policyholders, the death rate among males varied from 1¼ to nearly 3 times that among females. The higher ratios occurred at the older ages. In each sex, white persons recorded a higher mortality than nonwhites past midlife.

Data available for the general population of the United States show relatively large geographic variations in the death rate from cirrhosis of the liver. Compared with a national average of 9.9 per 100,000 in 1950-54, the death rate ranged from 3.7 in South Carolina to 18.5 in the District of Columbia. In general, the rates tend to be highest in the eastern industrial States and in California, and lowest in the South and Southwest. These variations undoubtedly reflect, in part, differences in the age composition of the population and in the accuracy of diagnosis and reporting of causes of death.

In recent years the recorded death rate from cirrhosis of the liver in our country has been increasing. This may be due to improved methods of diagnosis and hence more frequent reporting of the disease on death certificates, but it may also reflect the effect of the increased frequency of infectious and serum hepatitis.

The major contributory factors in the etiology of cirrhosis of the liver in the United States are thought to be certain types of dietary deficiencies, chronic alcoholism, bile duct disease, chemical toxins, and infections, among which may be infectious and serum hepatitis. The exact relationship of alcoholism to cirrhosis has not been definitely established, but it appears that the alcoholic's diet, if deficient in protein and certain vitamins, may predispose to cirrhosis. More than one fourth of the deaths from the disease are reported to be associated with alcoholism, but the reporting appears to be incomplete. Overweight adversely influences the mortality from cirrhosis, according to insurance experience. In a recent study among insured overweight men, the mortality from the disease was 2½ times that of standard risks.

The control of cirrhosis of the liver depends primarily on preventive measures, such as adequate nutrition, moderation in the use of alcohol, prevention or adequate therapy of damaging infections, avoidance of overexposure to toxic agents, and maintenance of body weight at desirable levels. Current methods of treatment are effective in mild and moderate cirrhosis, but further research is needed to develop adequate therapy for the advanced stages. Encouraging is the recent development of surgical procedures to combat late complications of cirrhosis.

MORTALITY FROM SELECTED CAUSES

Industrial Policyholders, Metropolitan Life Insurance Company
May 1957

Cause of Death	Annual Rate per 100,000 Policyholders*				
	May		Year to Date		
	1957†	1956	1957†	1956	1955
All Causes	633.4	636.2	669.3	669.9	650.3
Tuberculosis (all forms)	7.0	8.6	7.3	8.0	8.3
Communicable diseases of childhood	.3	.6	.2	.4	.4
Acute poliomyelitis	—	.1	‡	.1	.2
Malignant neoplasms	139.4	134.8	138.6	132.4	130.0
Digestive system	50.6	46.9	48.6	45.1	45.2
Respiratory system	19.2	17.6	19.4	17.8	16.7
Diabetes mellitus	14.9	15.7	14.9	16.7	16.0
Diseases of the cardiovascular-renal system	341.9	335.8	365.3	361.9	348.5
Vascular lesions, central nervous system	63.4	66.2	69.3	70.9	67.3
Diseases of heart	252.8	245.0	268.6	264.7	254.5
Chronic rheumatic heart disease	10.3	13.2	12.2	12.7	13.6
Arteriosclerotic and degenerative heart disease	200.7	188.4	208.9	206.0	195.2
Diseases of coronary arteries	113.7	106.7	118.5	117.1	112.6
Hypertension with heart disease	31.8	35.8	36.4	37.3	37.1
Other diseases of heart	9.9	7.6	11.0	8.7	8.6
Nephritis and nephrosis	7.4	7.3	8.5	8.3	9.4
Pneumonia and influenza	13.5	16.3	17.2	19.3	18.2
Complications of pregnancy, childbirth	.6	.8	.9	1.0	.8
Suicide	5.9	6.7	6.0	5.7	6.2
Homicide	2.7	2.4	2.7	2.1	2.1
Accidents—total	32.4	34.0	33.5	35.8	33.2
Motor vehicle	14.3	15.0	14.6	15.3	13.5
All other causes	74.8	80.4	82.7	86.5	86.4

*The death rates prior to March 1956 relate to persons insured under Industrial premium-paying policies and persons with Ordinary Monthly Premium Policies for Less Than $1,000; beginning with March 1956, included also are persons with Debit Book Ordinary policies for $2,000 or less.
†The death rates for 1957 are provisional.
‡Less than 0.05.

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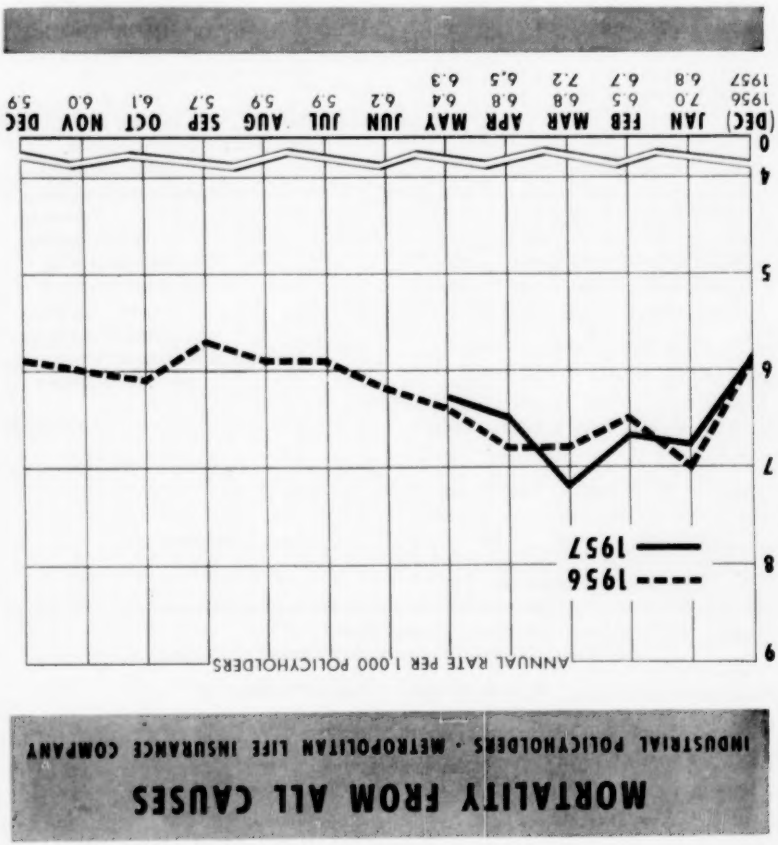
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